English-Kafir dictionary. Such works as those under review are, of course, valuable, but they would be twice as useful if, in addition to Kafir-English, an English-Kafir section was added. English-speaking people in South Africa will not find the work now under review of as much use or importance as philologists, because it will need endless searching to find therein the equivalent of some English word which they wish to translate into Kafir.

Mr. McLaren, in compiling the work under review, acknowledges his great indebtedness to the previously published monumental dictionary by Dr. Kropf, and to the great Zulu Dictionary of Bryant. Unfortunately, like most writers on the Kafir dialects, he adopts the South African orthography, which is devised without any regard to the existence of other languages in the world requiring to be spelt phonetically, and which ignored most of the suggestions made by Lepsius in his standard alphabet. To express the three or the four clicks used in the South African Bantu the letters *c*, *q*, and *x* are borrowed, oblivious of the fact that all are required and have long since been used in other phonetic systems to express the English ch, the Arabic ق, and the Greek χ. The Arabic guttural ق is of such common occurrence all over the world in languages too numerous to catalogue, that the symbol *q* is required for its expression, and is made use of more logically since this Semitic letter, borrowed by the Greeks and the Romans, had in Phœnician almost certainly the sound of the Arabic ق. In my own work on phonetic spelling, and in my study of the Bantu languages, which is gradually being printed by the Oxford University Press, I have been obliged to devise special type to indicate the clicks, because the symbols offered by Lepsius were too confusing to the eye when written or printed.

The term "Kafir" is, of course, exasperating to the logical mind, as it is nothing more than the Arab term "unbeliever," but it seems to have become permanently established in South Africa, and cannot be set aside—though why linguists like Mr. McLaren should wish to spell it with two f's instead of one is what I cannot understand. There is no general term other than Kafir to include the closely allied western dialects of the Zulu species—Xosa, Tembu, Pondo, Pondomisi, Xesibe. The other well-marked dialects on the east and north are Zulu and Swazi. The "Añgoni" of Gazaland (reaching also to Nyasaland) is perhaps a fourth sub-species. To those who cannot afford the big, heavy, and expensive (but most valuable) Kafir-English Dictionary of Dr. Kropf, the work under review will be useful, as it is light, compact, clearly printed, and priced at only 3*s*. 6*d*.

(2) Chikaranga is, as Mr. C. S. Louw informs us in his preface, the language spoken by the natives of Mashunaland in southern Rhodesia. It is a language divided into several well-marked dialects, and the general name of these is more correctly spelt (as it is pronounced) Karaña. The Karaña language is the southernmost member of that far-spread Nyanja group, which extends over the Shire basin half-way up Lake Nyasa, and includes most of the tongues of the lower Zambezi and of the Zambezi valley as far west as the vicinity of the Victoria Falls. The book under review is quite the best manual as yet published on this important speech. It consists of a grammar, exercises, and a copious vocabulary, virtually a dictionary, English-Karaña and Karaña-English. It is published by Philpott and Collins, Bulawayo, and it is a pity that no indication is given of any London agency, for the work is sure to be in request in that ever-widening circle of Bantu students, not only for its philological interest, but because a knowledge of Karaña is of really great importance to those who are proposing to settle and work in southern Rhodesia and adjoining portions of Portuguese south-east Africa.

H. H. JOHNSTON.

FINITE DIFFERENCES FOR ACTUARIES.

Elements of Finite Differences, also Solutions to Questions set for Part I. of the Examinations of the Institute of Actuaries. Second edition. By J. Burn and E. H. Brown. Pp. iii+289. (London: C. and E. Layton, 1915.) Price 10*s*. 6*d*. net.

THE first edition of this work, which is intended for students preparing for the first examination of the Institute of Actuaries, appeared in 1902. The present edition only differs from its predecessor in the addition to part i. of an alternative demonstration of Lubbock's formula for approximate summation, and of three chapters dealing with Stirling's Interpolation Formula, Interpolation for functions of two variables, and Interpolation of inverse functions.

The first two chapters give a clear and straightforward exposition of the elementary processes and formulæ. In the chapter on Interpolation, the usual Finite Difference methods and that of Legrange are given. In the case of a function which is given for *n* non-equidistant values of the variable, it is suggested that a possible method of procedure is to assume

$$U_x = A + Bx + Cx^2 + \dots + Dx^{n-1}.$$

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This leads to very heavy work which could have been avoided by taking

$$U_x = A + B(x-a) + C(x-a)(x-b) + \dots$$

where *a*, *b*, . . . are the values of x for which the function is given. This is actually given in a later chapter, but its use in this connection is not mentioned. The section on Two-Variable Interpolation seems out of place, in view of the introduction of a chapter dealing entirely with this branch of the subject. The short chapter on Central Differences, which is practically a reproduction of the obsolete, cumbersome, and imperfect demonstration given in the Institute of Actuaries' Text-book, part ii., might well have been dropped, as the work is redone by a better method in the chapter on Stirling's Formula. As is shown in the latter chapter, the formulæ follow at once from assumptions of the form

$$U_x = A + Bx + Cx(x-1) + D(x+1)x(x-1) + \dots$$

The authors, however, make their demonstrations unduly long by obtaining U_0, ΔU_0, $\Delta^2 U_{-1}$, . . . by detailed expression of U_0, U_1, U_{-1}, . . . in terms of A, B, . . . If U_x had been written in the form

$$A + Bx + \frac{Cx^{(2)}}{2!} + \frac{D(x+1)^{(3)}}{3!} + \dots$$

the difference of U_x for all values of x could have been written down without the tedious arithmetic which is employed. Two pages are devoted to the C.D. expansions of U_x in which the leading terms are $U_{\frac{1}{2}}$ and $U_{-\frac{1}{2}}$ respectively. All this is quite unnecessary, as the formulæ can be deduced from those already obtained by writing

$$U_x = U_{\frac{1}{2}+(x-\frac{1}{2})} \text{ or } U_{-\frac{1}{2}+(x+\frac{1}{2})}.$$

It is to be regretted that the opportunity was not taken to revise the chapter on Summation. The function is frequently written before the operator, and we have such surprising statements as

$$U_{a+x} = U_a(1+\Delta)^x,$$

$$U_a + U_{a+1} + \dots + U_{a+n-1} = U_a\left\{n + \frac{n(n-1)}{2!}\Delta + \dots\right\}$$

and the operators are spoken of as the *coefficients* of U_a. The introduction of the alternative so-called demonstration for Lubbock's formula is unfortunate, as the symbolical method employed is quite unsound, and may be mistaken by students for a proof. The chapter on Interpolation of Inverse Functions, consisting mainly of two examples, is unnecessary, and the examples might have been incorporated with those on Legrange's formula.

Three-quarters of the book (parts ii. to iv.) are taken up with solutions of questions set in the first examination of the Institute of Actuaries between the years 1887 and 1902. The questions include Permutations and Combinations, Binomial Theorem, Probabilities, and Elementary Finite Differences. The solutions are instructive, but those on Finite Differences follow too closely the methods of algebra text-books instead of the neater methods of Finite Differences. The incorrect solution to problem 212 given in the first edition is repeated, and the solution to problem 202, giving the expression of $U_0 + U_1x + U_2x^2 + \dots$ in terms of differences of U_0, should have been incorporated in the chapter on Summation. It would have been more useful to the students for whom the book is intended if solutions of questions from recent examination papers of the Institute of Actuaries had been given, as the syllabus now includes the elements of Differential and Integral Calculus.

PRACTICAL AND APPLIED CHEMISTRY.

(1) *Practical Physical Chemistry.* By Dr. A. Findlay. Third edition. Pp. xvi + 327. (London: Longmans, Green and Co., 1914.) Price 4*s.* 6*d.* net.

(2) *Practical Physical Chemistry.* By J. B. Firth. Pp. xii + 178. (London: Methuen and Co., Ltd., 1915.) Price 2*s.* 6*d.*

(3) *Volumetric Analysis.* By A. J. Berry. Pp. 137. (Cambridge: At the University Press, 1915.) Price 6*s.* 6*d.* net.

(4) *A First Course in Practical Chemistry for Rural Secondary Schools.* By W. Aldridge. Pp. xii + 122. (London: G. Bell and Sons, Ltd., 1915.) Price 1*s.* 6*d.*

(5) *Dyestuffs and Coal-Tar Products: their Chemistry, Manufacture, and Application.* By T. Beacall, Dr. F. Challenger, Dr. G. Martin, and Dr. H. J. S. Sand. Pp. vii + 156. (London: Crosby Lockwood and Son, 1915.) Price 7*s.* 6*d.* net.

(1) and (2) THE third edition of Prof. Findlay's "Practical Physical Chemistry" contains a description of several new experimental methods, especially in connection with the determination of vapour-densities, surface-tension by the drop method, molecular-weights, solubility and hydrolysis of salts by conductivity-measurements, and the measurement of decomposition and of ionic-discharge potentials. The new edition retains all the merits which have long been recognised in its predecessors.

Mr. Firth's book is of a similar type to Prof. Findlay's, and seems to indicate that a standard course of physical chemistry has now been developed, and is being followed with very little modification in a number of different centres. The coincidence in this case extends not merely to identical illustrations of standard apparatus, but even to the inclusion in each volume of a picture

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